

Serial No. 10/766,739
OKI 612
Reply Brief dated February 14, 2008

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of : Before the Board of Appeals
Kazuhide Abe : Appeal No.:
Serial No.: 10/766,739 : Group No.: 2814
Filed: January 29, 2004 : Examiner: J. Ingham
: Conf. No.: 2843

For: WIRING STRUCTURE OF SEMICONDUCTOR DEVICE AND METHOD OF
MANUFACTURING THE SAME

REPLY BRIEF

U.S. Patent and Trademark Office
****Via efilng****
Randolph Building
401 Dulany Street
Alexandria, VA 22314

Date: February 14, 2008

Sir:

In response to the Examiner's Answer dated **December 14, 2007**, Appellant.
hereby submits this Reply Brief.

Although Appellant generally reaffirms all of the arguments that were previously
presented in the Appeal Brief dated August 13, 2007, for brevity Appellant here only
specifically addresses the following arguments presented in the Examiner's Answer
dated December 14, 2007.

- 1) On page 7, lines 18-22 of the Examiner's Answer, the Examiner states the following with respect to the rejection of claim 12:

"Lim discloses stripe shaped protrusions, and stripe shaped wiring in trenches within the protrusions (see Lim Fig 14 and col 7 ln 56). Since the cap film taught by Higashi is formed on the wiring, it follows that the cap film will also be stripe shaped and therefore substantially the same shape as the uppermost faces of the protrusions."

Appellant again emphasizes that since TiN cap film 9 in Fig. 1G of the Higashi et al. reference (U.S. Patent No. 6,342,444) as relied upon is formed only on copper metal layer 6 and the edge of TiN metal layer 5, the structure of the combined teaching of the Higashi et al. reference and the Lim et al. reference (U.S. Patent No. 6,380,084) would not have a cap film on the hillock surrounding copper layer 84/barrier layer 80 in Fig. 14 of the Lim et al. reference. Since the cap film would not extend onto the hillock in the combined prior art and would only be formed over the copper layer 84 in Fig. 14 of the Lim et al. reference, the shape of the cap film would not extend onto the uppermost faces of the hillock and thus would not have substantially the same shape as uppermost faces of the hillocks. The prior art as combined would thus fail to meet the features of claim 12. Appellant thus respectfully submits that claim 12 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that the rejection of claims 12-15 and 33 is improper.

- 2) The Examiner has stated the following on page 8, lines 5-10 of the Examiner's

Answer with respect to claim 28:

"Lim discloses wiring within a groove in a protrusion that shares an upper face with the protrusion. A cap layer as taught by Higashi, that is formed on the upper face of the wiring, is also considered to be on upper faces of the protrusions. The claim language does not specify cap films formed in direct contact with the protrusions – and therefore the cap film formed above the interface created by the wiring and the protrusion upper face satisfies the limitations claimed."

TiN cap film 9 in Fig. 1G of the Higashi et al. reference is formed only on copper layer 6 and the edge of TiN metal layer 5, not on upper surfaces of insulation film 1. In contrast, the plural first cap films of claim 28 are featured as "formed on upper faces of the protrusions". The first insulating film of claim 28 is featured as having the plural protrusions. The protrusions of claim 28 are thus formed of the first insulating film. Consequently, the first cap films of claim 28 are formed on the first insulating film (protrusion). Contrary to the Examiner's assertion, TiN cap film 9 in Fig. 1G of the Higashi et al. reference is not on upper faces of a protrusion made of an insulating film, as would be necessary to meet the features of claim 28.

Moreover, the Examiner's assertion that the language of claim 28 does not specify cap films formed in direct contact with the protrusions is unclear, and would

appear irrelevant. As noted above, claim 28 includes in combination "plural cap films formed on upper faces of the first insulating film". Regardless of the Examiner's attempt to construe the plain meaning of the word "on", Fig. 1G of the Lim et al. reference does not disclose TiN cap film 9 formed on or over upper faces of a first insulating film, because TiN cap film 9 is formed only on copper metal layer 6 and the edge of TiN metal layer 5. The relied upon prior art thus fails to meet the features of claim 28. Appellant therefore respectfully submits that claim 28 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that the rejection of claims 28-32 and 34 is improper.

3) In the paragraph bridging pages 8 and 9 of the Examiner's Answer, the Examiner has stated the following with further regard to claim 28:

"Yu teaches that a second insulating cap film of silicon carbide (SiC) may be formed over a first conductive film to passivate the structure (col 5 ln 25-36). The first conductive cap film on wiring as taught by Higashi can therefore have an additional insulating cap film of SiC formed over it to passivate the structure."

The Examiner has attempted to characterize the conductive passivation layer of the Yu reference (U.S. Patent No. 6,958,291) as the second cap films of claim 28. However, the conductive passivation layer is very generally described in column 5, lines

33-36 of the Yu reference as "only overlying the second conductor as a capping layer". Although not entirely clear, it would appear that the "second conductor" referred to in the above noted passage of the Yu et al. reference may correspond to conductor 160 shown in Fig. 7 thereof. It would thus appear that the teaching in column 5, lines 33-36 of the Yu et al. reference suggests forming the conductive passivation layer only as overlying conductor 160. However, it is not clear if the conductive passivation layer of the Yu et al. reference is formed on conductor 160, or on passivation layer 170, or disposed overlying conductor 160 with passivation layer 170 excluded from the structure.

Regardless, the second cap films of claim 28 are featured as "formed on the first cap films and the first insulating film". It is clear that since the conductive passivation layer of the Yu et al. reference is generally described as merely formed "only overlying the second conductor", the conductive passivation layer is not formed on a first insulating film, as would be necessary to meet the features of claim 28. The relied upon prior art thus fails to meet the features of claim 28. Appellant therefore respectfully submits that claim 28 would not have been obvious in view of the prior art as relied upon by the Examiner taken singularly or together, and that the rejection of claims 28-32 and 34 is improper.

Conclusion

For all the foregoing reasons, Appellant respectfully submits that claims 12-16 and 28-34 are patentable over the cited prior art. Therefore, Appellant respectfully requests that claims 12-16 and 28-34 be allowed and that this application be passed to issue.

In the event that there are any outstanding matters remaining in the present application, please contact Andrew J. Telesz, Jr. (Reg. No. 33,581) at (571) 283-0720 in the Washington, D.C. area, to discuss these matters.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment for any additional fees that may be required under 37 C.F.R. 41.20 or 37 C.F.R. 1.17 and 1.136(a), or credit any overpayment, to Deposit Account No. 50-0238.

Respectfully submitted,

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